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(54) Title: *STAPHYLOCOCCUS AUREUS* GENES AND POLYPEPTIDES

(57) Abstract: The present invention relates to 11 novel genes from *S. aureus* and the polypeptides they encode. Also provided are vectors, host cells, antibodies and recombinant methods for producing the same. The invention further relates to screening methods for identifying agonists and antagonists of *S. aureus* polypeptide activity. The invention additionally relates to diagnostic methods for detecting *Staphylococcus* nucleic acids, polypeptides and antibodies in a biological sample. The present invention further relates to novel vaccines for the prevention or attenuation of infection by *Staphylococcus*.

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## INTERNATIONAL SEARCH REPORT

International application No.  
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**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : C12P 21/06; C12Q 1/68; C12N 1/20, 15/00; C07K 1/00; A61K 31/00  
US CL : 435/69.1, 6, 320.1, 252.3; 530/350; 424/185.1

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 435/69.1, 6, 320.1, 252.3; 530/350; 424/185.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
MEDLINE, EMBASE, BIOSIS, BIOTECHDS, SCISEARCH, HCAPLUS, NTIS, LIFESCI, BRSE/AST

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	Database SPTREMBL-15, Accession No. O33609, SUGAI et al., 'epr, which encodes glycyglycine endopeptidase resistance, is homologous to femAB and affects serine content of peptidoglycan cross bridges in Staphylococcus capitis and Staphylococcus aureus,' 01 January 1997. See residues 321-342 of both sequences.	3, 9, 12-13, 22 ----- 24, 25
X ----- Y	Database PIR-66, Accession No. S06783, BERGER-BAECHI et al., 'FemA, a host-mediated factor essential for methicillin resistance in Staphylococcus', 30 September 1991, see residues 49-59 of SEQ ID NO:2 matching their sequence.	3, 9, 12-13, 22 ----- 24-25

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"G" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 20 FEBRUARY 2001	Date of mailing of the international search report 30 MAR 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-9230	Authorized officer MARYAM MONSHIPOURI Telephone No. (703) 305-0196

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/05976

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:  
1-13, 19-22 and 24-25 (species A)

Remark on Protest

☐  
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/05976

### BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-13, 19-22 and 24-25, drawn to isolated nucleic acid molecules encoding polypeptides from *Staphylococcus aureus* (femX), homologs thereof, vectors, and host cells comprising said molecules or fragments thereof, FemX polypeptides, fragments of said polypeptides with biologic or antigenic activities, and a vaccine comprising said polypeptides or fragments thereof as well as a method of preventing infection comprising administering said femX polypeptides.

Group II, claim(s) 14-18, 23 and 28-29, drawn to isolated antibodies which specifically bind *Staphylococcus* polypeptides or fragments thereof, a hybridoma cell line producing said antibodies, and a kit comprising said antibodies.

Group III, claims 26-27, drawn to a method of detecting *staphylococcus* nucleic acids in a sample comprising contacting the sample with probes that hybridize to said nucleic acids under hybridization conditions.

The inventions listed as Groups I-III do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of Group I is polypeptide which has a different chemical structure and function from special technical features of Groups II and III which are antibody and DNA respectively.

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows:

SEQ ID NO:1-2 (species A), SEQ ID NO:3-4 (species B), SEQ ID NO:5-6 (species C), SEQ ID NO:7-8 (species D), SEQ ID NO: 9-10 (species E), SEQ ID NO: 11-12 (species F), SEQ ID NO:13-14 (species G), SEQ ID NO:15-16 (species H), SEQ ID NO:17-18 (species I), SEQ ID NO: 19-20 (species J), SEQ ID NO:21-22 (species K).

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: each pair of sequences (shown above) is directed to a polypeptide of a different chemical structure and function.